IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES
Attorney Docket No. 137782 (15221US01)

In the Application of: Joel F. Zuhars et al. Serial No. 10/771,074 Filed: February 3, 2004 For: METHOD AND APPARATUS FOR INSTRUMENT TRACKING ON A SCROLLING SERIES OF 2D FLUOROSCOPIC IMAGES Examiner: Bitar, Nancy Group Art Unit: 2624 Confirmation No. 1973	**Electronically filed on March 28, 2011**

APPEAL BRIEF

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from an Office Action dated October 27, 2010 ("Final Office Action"), in which claims 1-3, and 5-20 were finally rejected. The Appellant respectfully requests that the Board of Patent Appeals and Interferences ("Board") reverse the final rejection of claims 1-3, and 5-20 of the present application. This Appeal Brief is timely filed because it is being filed within the two-month period for reply that ends on **March 28, 2011** (the Office date of receipt of the Notice of Appeal being January 27, 2011).

REAL PARTY IN INTEREST
(37 C.F.R. § 41.37(c)(1)(i))

GE Medical Systems, Global Technology Co., LLC having a place of business at 3000 N. Grandview Boulevard, Waukesha, Wisconsin 53188 has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefore, as set forth in the Assignment recorded at Reel 15006, Frame 0560 in the PTO Assignment Search room.

RELATED APPEALS AND INTERFERENCES
(37 C.F.R. § 41.37(c)(1)(ii))

The Appellant is unaware of any related appeals or interferences.

STATUS OF THE CLAIMS
(37 C.F.R. § 41.37(c)(1)(iii))

Claims 1-3, and 5-20 were finally rejected in the Final Office Action mailed October 27, 2010. Claim 4 was previously canceled in Appellants' June 19, 2007 response.[1]

The present application includes claims 1-3, and 5-20, which are pending in the present application. The Office Action rejected claims 1-3 and 5-20 under 35 U.S.C. §103(a) over Jensen et al. (US 6,666,579) ("Jensen") in view of Zylka et al. (US 2001/0027263) ("Zylka").[2]

The Appellants identify claims 1-3, and 5-20 as the claims that are being appealed. The text of the pending claims is provided in the Claims Appendix.

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[1] *See* Amendment and Response, June 19, 2007 at pages 2, 6.
[2] *See* Final Office Action, October 27, 2010 at page 3.

STATUS OF AMENDMENTS
(37 C.F.R. § 41.37(c)(1)(iv))

In response to the Final Office Action mailed October 27, 2010, the Appellants filed a Response after Final[3] addressing the Office Action's new grounds for rejection made in view of Zylka[4]. No claims were amended subsequent to the October 27, 2010 Final Office Action. An Advisory Action, mailed January 19, 2011, entered the Appellants' amendments;[5] however, the Advisory Action maintained the rejections of claims 1-3, and 5-20 under 35 U.S.C. § 103(a).[6] In response to the Advisory Action mailed January 19, 2011, the Appellant filed a Notice of Appeal.[7] Accordingly, the Appellants have filed this Appeal Brief.

SUMMARY OF CLAIMED SUBJECT MATTER
(37 C.F.R. § 41.37(c)(1)(v))

Independent claim 1 recites the following:

A method of performing instrument tracking on an image comprising:[8]

collecting in a collection device that rotatably moves a plurality of static 2D images using an image processing computer;[9]

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[3] See Response After Final, December 27, 2010.
[4] *See* Final Office Action, October 27, 2010, Page 2.
[5] *See* January 19, 2011 Advisory Action at page 1, point 7.
[6] *See* January 19, 2011 Advisory Action at page 1, point 11.
[7] *See* January 27, 2011 Notice of Appeal
[8] *See* present application, e.g., at page 3, lines 5-6.
[9] *See id.* e.g., page 4, lines 27-29; page 5, lines 5-8; page 12, lines 9-10; Fig. 1 (110, ,160); Fig 3 (310, 320).

computing on a tracking data processor at least one of a position and orientation of at least one instrument for said plurality of static images;[10] and

automatically displaying on an output device each image in said collected plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation process, wherein said at least one position and orientation of said at least one instrument is projected on each said image.[11]

Claims 2-3 and 5-9 are dependent upon claim 1.

Independent claim 10 recites the following:

A method of performing instrument tracking on a series of static images using an imaging device, comprising:[12]

collecting a series of 2D static images in a collection device that rotatably moves using an image processing computer;[13]

calibrating said series of 2D static images in said collection device using said image processing computer such that at least one of a position and orientation of at least one instrument may be accurately displayed in each image of said series of static images;[14]

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[10] *See id.* e.g., page 3, lines 8-10; page 4, lines 2-3,26-27; page 5, lines 10-11; page 8, lines 16-18; page 15, lines 31-33; Fig. 2 (230); Fig. 3 (350).
[11] *See id., e.g.,* at page 3, lines 24-28; page 7, line 20-page 8, line 7; page 14, line 17-page 15, line 2; page 16, lines 3-17.
[12] *See id.*, at page 5, lines 17-18; page 7, lines 7-8.
[13] *See id.*, at page 3, lines 24-26; page 4; lines 18-19, lines 27-29; page 15, lines 19-24; page 16, lines 24-27; Fig. 2 (210); Fig. 3 (320).

selecting at least one image of said series of 2D static images to be a current image;[15]

computing in a tracking data processor said at least one position and orientation of said at least one instrument for said current image;[16]

projecting said at least one position and orientation within said current image; [17]

displaying said current image on an output device;[18] and

automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images.[19]

Claims 11-17 are dependent upon claim 10.

Independent claim 18 recites the following:

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[14] *See id.*, at page 3, lines 26-page 4, line 2; page 14, lines 29-31; page 15, lines 24-26; page 16, lines 29-31; Fig. 2 (220); Fig.3 (330).
[15] *See id.*, at page 4, lines 21-23; page 16, line 33-page 17, line 1; Fig. 2 (240); Fig. 3 (340).
[16] *See id., e.g.,* at page 4, lines 2-3, lines 23-24; page 17, lines 1-2; Fig. 3 (350).
[17] *See id., e.g.,* at page 4, line 24; page 17, line 4-5; Fig. 3 (352).
[18] *See id., e.g.,* at page 4, line 25; page 7, line 29-page8, line 8; page 14, line 24-page 15, line 2; page 17, lines 7-8; Fig. 3 (354).
[19] *See id., e.g.,* at page 17, lines 9-16; page 16, line 4-11; Fig. 3 (358).

An apparatus for performing instrument tracking on a series of static images, the apparatus comprising:[20]

a collection device that rotatably moves and is adapted to collect a series of static images using an image processing computer;[21]

a processing device communicating with at least said collection device and adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images including at least one of a position and orientation of at least one instrument and at least one image of said at least one instrument located at said at least one of a position and orientation; [22]and

an output communicating with at least said processing device and adapted to display said image by image animation of said series of static images.[23]

Claims 19-20 are dependent upon claim 18.

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[20] *See id., e.g.,* at page 5, lines 4-5; page 7, lines 6-8.
[21] *See id., e.g.,* at page 4, lines 27-29; page 5, lines 5-11; page 9, lines 10-17; page 13, lines 16-22; Fig. 1 (110, 160).
[22] *See id., e.g.,* at page 5, lines 15-17; page 7, line 29-page 8, line 7; page 9, lines 15-17, page 14, line 24-page 15, line 2; Fig. 1 (110, 130, 160, 170, 190).
[23] *See id., e.g.,* at page 5, lines 11-13; page 13, lines 6-13; page 14, lines 24-31; Fig. 1 (160, 190).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL
(37 C.F.R. § 41.37(c)(1)(vi))

Claims 1-3 and 5-20 stand rejected under 35 U.S.C. §103(a) over Jensen et al. (US 6,666,579) ("Jensen") in view of Zylka et al. (US 2001/0027263) ("Zylka").[24]

[24] *See* Final Office Action, October 27, 2010 at page 3.

ARGUMENT
(37 C.F.R. § 41.37(c)(1)(vii))

In the Final Office Action, claims 1-3 and 5-20 were rejected under 35 U.S.C. §103(a) over Jensen et al. (US 6,666,579) ("Jensen") in view of Zylka et al. (US 2001/0027263) ("Zylka").

I. Claims 1-3 and 5-20 Are Not Obvious Over Jensen in view of Zylka

Claims 1-3 and 5-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jensen in view of Zylka.

A. Rejection of Independent Claim 1

The Appellant turns to the rejection of independent claim 1 under 35 U.S.C. § 103(a) as being unpatentable over Jensen in view of Zylka. The Appellants submit that the combination of Jensen and Zylka does not disclose or suggest at least the limitation of "automatically displaying on an output device each image in said collected plurality of static 2D images in sequential image by image manner to **create 3D information** of said position and orientation of said instrument by creating **motion through the animation process**, wherein said at least one position and orientation of said at least one instrument is projected on each said image," as set forth in Appellants' independent claim 1.

Appellant notes that independent claim 1 is related to a method where a collection device collects a series of 2D images using a moveable collection device and taking advantage of a human's natural abilities to perceive 3D information when motion is introduced to a static set of

2D images. Specifically, the Appellants' claim 1 recites that scrolling the 2D images allows the user to perceive 3D information and understand the instrument position and/or orientation information in 3D.

The final Office Action quotes the following passage from Jensen to support that Jensen discloses the above limitation of claim 1: "The display graphics processor 295 accesses the slice data set memory 290 to display the image slices on the display 250. The display graphics processor 295 also constructs graphical representations of the instrument or tool 24 and overlays the instrument graphic with the image slices on the display 250. The display graphics processor 295 may present multiple two-dimensional image slices simultaneously on the display 250 with instrument graphics superimposed upon each image slice. Col 10, lines 25-50." [25]

Appellants respectfully submit that Jensen does not teach, suggest or disclose animation. Independent claim 1 recites the feature of "automatically displaying on an output device each image in said collected plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating **motion through the animation process**, wherein said at least one position and orientation of said at least one instrument is projected on each said image," as set forth in Appellant's independent claim 1. Jensen does not teach that the images are automatically displayed in an image by image to create an animation. Rather than creating motion through animation as recited in claim 1 to create 3-D images, Jensen teaches that "[t]he 3-D patient data set may be constructed in step 325 using any one of several algorithms known for constructing three-dimensional data volumes based upon exposures obtained from a cone beam source. By way of example, the 3-D patient

[25] Final Office Action, October 27, 2010, pages 4-6.

data set may be constructed at step 325 using any one of several well known techniques, such as forward and/or back projection techniques. the patient slices and 3-D images constructed in step 335 may be created in accordance with any of several known algorithms such as those used in connection with existing ct systems. the 3-D images constructed at step 335 and displayed at step 340 may be created from the 3-D patient data set based upon any one of several known volume rendering techniques, such as ray casting and the like. several known techniques exist for constructing data sets of patient slices (such as for sagittal, coronal and axial patient views), segments and 3-D rendered images."[26]

Nowhere does Jensen teach, suggest or disclose that the plurality of static 2D images are displayed in such a manner as to create 3D information using animation as claimed in claim 1 of the instant application. Clearly, Jensen does not teach, disclose or suggest the use of an animation using static 2D images to create 3D information. Rather Jensen teaches using "any one of several algorithms known for constructing three-dimensional data volumes based on exposures obtained from the cone beam source."[27]

Further, Appellants respectfully submit, and the Office Action admits, that Jensen fails to teach, suggest or disclose the technology in the presently amended claim 1 of collecting a "plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation

[26] *See e.g.*, Jensen, U.S. Patent No. 6,666,579, column 12, lines 27-43.
[27] *id.*

process, wherein said at least one position and orientation of said at least one instrument is projected on each said image."[28]

The Office Action points to Zylka to cure the deficiencies of Jensen.[29] Appellants respectfully submit that nowhere does Zylka teach, disclose or suggest animation of 2D static images to create 3D information of the instrument's position and/or orientation. The final Office Action admits Jensen does not "specifically teach collected plurality of static images in sequential image by image manner to create motion through the animation process, wherein said at least one position and orientation of said at least one instrument is projected on each said image."[30] Appellant respectfully submits that Zylka also fails to specifically teach this admitted shortcoming of Jensen. Rather, Zylka relates to a method of and a device for determining the position of a medical instrument partly introduced into an object to be examined, in a three-dimensional image data set of the object to be examined.[31] Thus, Zylka does not teach suggest or disclose creating 3D images using 2D static images. The Office Action quotes in part paragraph 0019 of Zylka as support that Zylka teaches the feature in claim 1 of displaying each image in said "collected plurality of static images in sequential image by image manner to create motion through the animation process, wherein said at least one position and orientation of said at least one instrument is projected on each said image."[32] The quoted Paragraph 0019 of Zylka states in part:

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[28] Final Office Action, October 27, 2010, page 4.
[29] *id.*
[30] *id.*
[31] *See e.g.*, Zylka at Abstract.
[32] Final Office Action, October 27, 2010, page 4

> position measuring device 13 with two infrared CCD cameras 14 which are arranged on a stand to the side of the examination zone. The spatial positions of correspondingly constructed infrared light-emitting diodes can be determined by means of said cameras. In order to determine the position of a medical instrument 16 used during the intervention, in this case being a biopsy needle, the end of the biopsy needle 16 which projects from the patient is provided with three of such infrared light-emitting diodes 17 in defined positions. In order to determine the position of the X-ray device 2, or the imaging geometry of the X-ray device 2, during the acquisition of X-ray images during the operation, three of such light-emitting diodes 18 and 19, respectively, are provided on the X-ray source 6 and the X-ray detector 7, respectively. The spatial position of an acquired X-ray image can be determined from the imaging geometry thus determined, that is, the position of the X-ray image relative to the patient 3.[33]

As can be seen by a reading of the Office Action quoted paragraph 0019 of Zylka, this paragraph discloses that the spatial relationship between light emitting diodes placed on the medical instrument and the X-ray device. The spatial relationship is determined in arithmetic unit 20. Nowhere does Zylka disclose the feature in claim 1 of "automatically displaying on an output device each image in said collected plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation process." Rather, Zlyka discloses the determining the position of the medical instrument in relation to the X-ray source and X-ray detector.[34] From such data the arithmetic unit determines the spatial relationship between the 2D image data set and a 3D image data set.[35] In Zylka, the 3D image data set is one derived from a pre-operative CT images of the patient[36] and not from "automatically displaying on an output device each image in said

[33] *See e.g.*, Zylka paragraph 0019.
[34] *See id.*
[35] *See id* at paragraph 0020.
[36] *See id* at paragraphs 0016, 0017.

collected plurality of static 2D images in sequential image by image manner to create 3D information" as recited in independent claim 1.

Further, the Office Action alleges that "the displaying device [paragraph 0019] displays as a sequence of images (i.e. animation) along with a position and orientation of said instrument, wherein said at least one position and orientation of said at least one instrument is projected on each image."[37] Rather than displaying a sequence of images to create 3D information of said position and orientation through the animation process as alleged in the Final Office Action in paragraphs 0019 of Zylka, this paragraph discloses placing light emitting diodes on the X-ray device and the medical instrument and then uses this information along with the 3D image set acquired by the computed tomography apparatus to determine the spatial correlation between the two-dimensional X-ray image and the three dimensional image data set.[38] After determination of the correlation in arithmetic unit the position of the medical instrument can be transformed into a position relative to the three dimensional image data set and this can be displayed on a monitor.[39] Nowhere does Zylka teach, disclose or suggest the feature of "automatically displaying on an output device each image in said collected plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation process, wherein said at least one position and orientation of said at least one instrument is projected on each said image." Nowhere does Zukav disclose using the natural human ability to perceive 3D information from animated 2D data to transfer the position and/or orientation of a surgical instrument to a user.

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[37] *See* Final Office Action, October 27, 2010 at page 4.
[38] *See* Zylka at paragraph 0019.
[39] *See* Zylka at paragraph 0020.

Unlike the technology in the present amended claim 1, Appellants respectfully submit that Zylka does not disclose, teach or suggest collecting "a plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation process, wherein said at least one position and orientation of said at least one instrument is projected on each said image." Rather, unlike the present technology which uses scrolling the images to enable the user to understand the instrument information in 3D, Zylka uses an arithmetic unit to correlate the spatial correlation of the two-dimensional X-ray image and the three dimensional image data set that was derived from computer tomograms of the patient taken prior to surgical intervention.[40]

Similarly, the combination of Jensen and Zylka fails to disclose "collected plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation process." In Jensen, the "[t]he image volume process 270 constructs a three-dimensional patient data volume in the volumetric image memory 280.[41] Or alternatively, in Jensen, "[a]lternatively or in combination with image slices, the display graphics processor 295 may construct a three dimensional rendering of the 3-D patient data volume and display the three dimensional rendering on the display 250."[42] In Zylka, "[s]uch computer tomograms form a three-dimensional image set for a three dimensional reproduction of the examination zone of the patient."[43] As Jensen discloses using an image volume processor or a display graphics processor to construct three dimensional

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[40] *See e.g.*, Zylka, paragraphs 0019, 0020.
[41] *See e.g.*, Jensen, column 10, lines 15-17.
[42] *id.* at column 10, lines 33-37.
[43] *See e.g.*, Zylka, paragraph 0017. .

patient data and as Zylka discloses using the three dimensional image data set from the computed tomography apparatus, nowhere does the combination of Jensen and Zylka disclose animation of the 2D images to create 3D images through animation. Neither Jensen or Zylka taken alone or in theoretical combination create 3D information by animation of 2D images.

Accordingly, independent claim 1 is not unpatentable over Jensen in view of Zylka and is allowable. Furthermore, the appellant reserves the right to argue additional reasons beyond those set forth herein to support the allowability of claim 1.

B. Rejection of Dependent Claims 2-3, and 5-9

Claims 2-3 and 5-9 depend on independent claim 1. Therefore, the Appellant respectfully submits that claims 2-3 and 5-9 are allowable over the references cited in the final Office Action at least for the reasons stated above with regard to claim 1.

C. Rejection of Independent Claim 10

The Appellants now turns to the rejection of independent claim 10 under 35 U.S.C. § 103(a) as being unpatentable over Jensen in view of Zylka. The Appellants submit that the combination of Jensen and Zylka does not disclose or suggest at least the limitations of "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images," as set forth in Appellants' independent claim 10.

The Appellants note that the final Office Action mailed October 27, 2010 mischaracterizes claim 10. The final Office Action recites "automatically repeating said

selecting, computing, projecting, and displaying steps to create an animation using a sequential image by image presentation through said series of 2D static images" as the purported limitation at issue in claim 10[44] This is an incorrect claim limitation. Actually, the claim limitation recited in the October 27, 2010 final Office Action was originally presented in a November 15, 2007 Response After Final to a September 18, 2007 final Office Action.[45] In an Advisory Action mailed November 26, 2007, the amended claims were not entered.[46] The Appellants then filed a Request for Continued Examination on December 14, 2007 containing the amended claim presently cited by the October 27, 2010 Office Action.[47] Notice that this amended limitation was entered into record was contained in a non-final Office Action mailed December 21 2007.[48] This limitation was subsequently amended several times and in a Response to a non-final Office Action mailed May 6, 2010,[49] this limitation was amended to recite the present limitation in a August 6, 2010 Amendment and Response of "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D images."[50] In a Response After Final which was filed on December 27, 2010[51], the Appellants did not amend the present limitation of claim 10. In an

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[44] Final Office Action, October 27, 2010, page 6.
[45] Response After Final, November 15, 2007.
[46] *See* Advisory Action, November 26, 2007, Page 2.
[47] *See* Request for Continued Examination, December 14, 2007, page 3.
[48] *See* non-final Office Action, December 21, 2007, page 2.
[49] *See* Non-Final Office Action, May 6, 2010.
[50] *See* Amendment and Response, August 6, 2010.
[51] *See* Response After Final, December 27, 2010.

Advisory Action mailed January 19, 2010, the claims were entered.[52] Therefore, the actual claim limitation should read "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images," not "automatically repeating said selecting, computing, projecting, and displaying steps to create an animation using a sequential image by image presentation through said series of 2D static images." Accordingly, the Appellants ask this rejection be withdrawn and a notice of allowance be issued for at least this claim.

Alternatively, the Appellants present arguments below addressed to the correct claim limitation and shows that the correct claim limitation is not obvious over Jensen in view of Zylka.

Turning next to independent claim 10, the Office Action alleges that "the limitation of claim 10 has been addressed above except the following "automatically repeating said selecting, computing, projecting, and displaying steps to create an animation using a sequential image by image presentation through said series of 2D static images." The Office Action then simply alleges that Zylka teaches this limitation in paragraphs 0019-0025. [53]

As presented above, nowhere does Zylka teach, suggest or disclose the correct limitation in claim 10 of "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through

[52] *See* Advisory Action, January 19, 2011 at page 1, point 7.
[53] *See* Final Office Action, October 27, 2010, page 6.

said series of 2D static images" as recited in claim 10 of the instant application. As stated above, rather than using sequential image by image presentation of 2D images to create 3D information recited in the limitation of claim 10, Zylka uses an arithmetic unit for determining the spatial correlation between the two dimensional X-ray image and the three dimensional image data set derived from computed tomography prior to the operation for determining the position of the medical instrument in the computed tomography derived three dimensional image data set.[54]

Appellant respectfully submits that Zylka also fails to specifically teach the admitted shortcoming of Jensen. Rather Zylka relates to a method of and a device for determining the position of a medical instrument partly introduced into an object to be examined, in a three-dimensional image data set.[55] The Office Action points to paragraphs 0019-0025 of Zylka as support that Zylka teaches the feature in claim 10 of displaying each image in said "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images."[56] Paragraph 0019 of Zylka states in part:

> position measuring device 13 with two infrared CCD cameras 14 which are arranged on a stand to the side of the examination zone. The spatial positions of correspondingly constructed infrared light-emitting diodes can be determined by means of said cameras. In order to determine the position of a medical instrument 16 used during the intervention, in this case being a biopsy needle, the end of the biopsy needle 16 which projects from the patient is provided with three of such infrared light-emitting diodes 17 in defined positions. In order to determine the position of the X-ray device 2, or the imaging geometry of the X-ray device 2, during the acquisition of X-ray images during the operation, three of such light-

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[54] *See e.g.*, Zylka at paragraph 0020.
[55] *See e.g.*, Zylka at Abstract.
[56] Final Office Action, October 27, 2010.

> emitting diodes 18 and 19, respectively, are provided on the X-ray source 6 and the X-ray detector 7, respectively. The spatial position of an acquired X-ray image can be determined from the imaging geometry thus determined, that is, the position of the X-ray image relative to the patient 3.[57]

As can be seen by a reading of the Office Action quoted paragraph 0019 of Zylka, this paragraph discloses that the spatial relationship between light emitting diodes placed on the medical instrument and the X-ray device. The spatial relationship is determined in arithmetic unit 20. Nowhere does Zylka disclose the limitation in claim 10 of "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images." Rather, Zylka discloses the determining the position of the medical instrument in relation to the X-ray source and X-ray detector.[58] From such data, the arithmetic unit determines the spatial relationship between the 2D image data set and the 3D image data set.[59] In Zylka, the 3D image data set is one derived from a pre-operative CT images of the patient[60] and not from "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images" as claimed in independent claim 10.

Rather than "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information" Zylka discloses placing light emitting diodes on the

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[57] *See e.g.*, Zylka paragraph 0019.
[58] *See e.g.*, Zylka, paragraph 0019.
[59] *See e.g.*, Zylka, paragraph 0020.
[60] *See e.g.*, Zylka, paragraph 0017.

X-ray device and the medical instrument and then uses this information along with the 3D image set acquired by the computed tomography apparatus to determine the spatial correlation between the two-dimensional X-ray image and the three dimensional image data set. After determination of the correlation in arithmetic unit the position of the medical instrument can be transformed into a position relative to the three dimensional image data set and this can be displayed on a monitor.[61] Nowhere does Zylka teach, disclose or suggest the feature of "automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images" Nowhere does Zylka disclose using the natural human ability to perceive 3D information from animated 2D data to transfer the position and/or orientation of a surgical instrument to a user.

Unlike the technology in correct amended claim 10, Appellants respectfully submit that Zylka does not disclose, teach or suggest of “"automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images" Rather, unlike the present technology which uses scrolling the images to enable the user to understand the instrument information in 3D, Zylka uses an arithmetic unit to correlate the spatial correlation of the two-dimensional X-

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[61] *See e.g.*, Zylka, paragraph 0020.

ray image and the three dimensional image data set[62] that was derived from computer tomograms taken prior to surgical intervention.[63]

Paragraphs 0021-0025 are additionally cited by the Office Action in support that Zylka teaches the correct limitation of claim 10.[64] Paragraphs 0021 and 0022 relate to a method of acquiring 3D information during the pre-operative step[65] and then the two dimensional X-ray image and the position medical instrument are determined and the correlation between the X-ray image and the overall volume three dimensional image set acquired by compute tomography apparatus.[66] Paragraph 0023 discloses determining the position of the medical instrument in the overall computed tomography image set.[67] Paragraphs 0024-0025 disclose the comparison method for determining the correlation rule for determining the correlation between the X-ray image and the three dimensional image data set.[68] Nowhere does Zylka disclose creating a 3D image set from animation of the 2D X-ray.

Similarly, the combination of Jensen and Zylka fails to disclose “"automatically repeating said selecting, computing, projecting, and displaying steps to create 3d information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2d static images” In Jensen, the “[t]he image volume process 270 constructs a three-dimensional patient data volume

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[62] *See e.g.*, Zylka, paragraph 0020.
[63] *See e.g.*, Zylka, paragraph 0017.
[64] Final Office Action, October 27, 2010, Page 6.
[65] *See e.g.*, Zylka, paragraph 0021.
[66] *See e.g.*, Zylka, paragraph 0022.
[67] *See e.g.*, Zylka, paragraph 0023.
[68] *See e.g.*, Zylka, paragraph 0024-0025.

in the volumetric image memory 280."[69] Or alternatively, in Jensen, "[a]lternatively or in combination with image slices, the display graphics processor 295 may construct a three dimensional rendering of the 3-D patient data volume and display the three dimensional rendering on the display 250."[70] In Zylka, "[s]uch computer tomograms form a three-dimensional image set for a three dimensional reproduction of the examination zone of patient 3."[71] As Jensen discloses using an image volume processor or a display graphics processor to construct three dimensional patient data and Zylka discloses using the three dimensional image data set from the computed tomography apparatus, nowhere does the combination of Jensen and Zylka disclose animation of the 2D images to create 3D images through animation. Neither Jensen or Zylka alone or in theoretical combination create 3D information by animation of 2D images.

As presented above, nowhere does Zylka teach, suggest or disclose ""automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images" as recited in claim 10 of the instant application. As stated above, rather than using sequential image by image presentation of 2D images to create 3D information in the technology in claim 10, Zylka uses an arithmetic unit for determining the spatial correlation between the two dimensional X-ray image and the three dimensional image data set for determining the position of the medical instrument in the three dimensional image data set.

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[69] *See e.g.*, Jensen, column 10, lines 15-17.
[70] *id.* at column 10, lines 33-37.
[71] *See e.g.*, Zylka, paragraph 0018.

Further, Appellants respectfully submit that the combination of Jensen and Zylka would not make the claimed invention obvious to one of ordinary skill in the art at the time of the invention. The Office Action provides no rationale for its conclusionary statement that with the combination of Jensen and Zylka, neither of which disclose the feature of automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images, would be obvious to one of ordinary skill in the art.

Thus, for at least this reason, Appellants respectfully submit that neither Jensen nor Zylka, taken alone or in theoretical combination, teaches or reasonably suggests all the limitations of claim 10. Appellants respectfully submit that current independent claim 10 is in condition for allowance.

D. Rejection of Dependent Claims 11-17

Claims 11-17 depend on independent claim 10. Therefore, the Appellant submits that claims 11-17 are allowable over the references cited in the Final Office Action at least for the reasons stated above with regard to claim 10.

E. Rejection of Independent Claim 18

The Appellants now turn to the rejection of claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Jensen in view of Zylka. The Appellants submit that the combination of Jensen and Zylka does not disclose or suggest at least the limitation of "adapted to create 3D information by creating motion through the animation process by automatically and continuously

presenting an image by image animation of said series of static images" as set forth in Appellant's independent claim 18.

In regards to independent claim 18 and dependent claims 19-20, the Office Action simply states that "the limitation of Claims 18-20 has been addressed above."[72] Appellants assume that the limitation the Final Office Action is referring to is "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images."

Appellants respectfully submit that Jensen does not teach, suggest or disclose animation. Independent claim 18 recites "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images" as set forth in Appellants' independent claim 18. Jensen does not teach that the images are automatically displayed in an image by image to create an animation. Rather than creating an animation as recited in claim 18 to create 3-D images, Jensen teaches that "the 3-D patient data set may be constructed in step 325 using any one of several algorithms known for constructing three-dimensional data volumes based upon exposures obtained from a cone beam source. by way of example, the 3-D patient data set may be constructed at step 325 using any one of several well known techniques, such as forward and/or back projection techniques. the patient slices and 3-D images constructed in step 335 may be created in accordance with any of several known algorithms such as those used in connection with existing ct systems. the 3-D images constructed at step 335 and displayed at step 340 may be created from the 3-D patient data set based upon any one of several known volume rendering techniques,

[72] Final Office Action, October 27, 2010 at page 8.

such as ray casting and the like. several known techniques exist for constructing data sets of patient slices (such as for sagittal, coronal and axial patient views), segments and 3-D rendered images."[73]

Nowhere does Jensen teach, suggest or disclose that the static 2D images are displayed in such a manner as to create an animation as claimed in claim 18 of the instant application. Clearly, Jensen does not teach, disclose or suggest the creation of an animation using static 2D images to create 3D information. Rather Jensen teaches using "any one of several algorithms known for constructing three-dimensional data volumes based on exposures obtained from the cone beam source."[74]

Appellants respectfully submit that Zylka also fails to specifically teach the admitted shortcoming of Jensen. Rather, Zylka relates to a method of and a device for determining the position of a medical instrument partly introduced into an object to be examined, in a three-dimensional image data set.[75] Paragraph 0019 of Zylka states in part:

> position measuring device 13 with two infrared CCD cameras 14 which are arranged on a stand to the side of the examination zone. The spatial positions of correspondingly constructed infrared light-emitting diodes can be determined by means of said cameras. In order to determine the position of a medical instrument 16 used during the intervention, in this case being a biopsy needle, the end of the biopsy needle 16 which projects from the patient is provided with three of such infrared light-emitting diodes 17 in defined positions. In order to determine the position of the X-ray device 2, or the imaging geometry of the X-ray device 2, during the acquisition of X-ray images during the operation, three of such light-emitting diodes 18 and 19, respectively, are provided on the X-ray source 6 and the X-ray detector 7, respectively. The spatial position of an acquired X-ray image

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[73] See *e.g.*, Jensen, column 12, lines 27-43.
[74] *id.*
[75] *See e.g.*, Zylka at Abstract.

> can be determined from the imaging geometry thus determined, that is, the position of the X-ray image relative to the patient 3.[76]

As can be seen by a reading of paragraph 0019 of Zylka, Zylka discloses the spatial relationship between light emitting diodes placed on the medical instrument and the X-ray device.[77] The spatial relationship is calculated in calculation unit 15 and the results stored in arithmetic unit 20.[78]. Nowhere does Zylka disclose the feature in claim 18 of "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images." Rather, Zylka discloses the determining the position of the medical instrument in relation to the X-ray source and X-ray detector. From such data the arithmetic unit determines the spatial relationship between the 2D image data set and the 3D image data set.[79] In Zylka, the 3D image data set is one derived from a pre-operative CT images of the patient[80] and not from "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images" as claimed in independent claim 18.

Rather than "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images," Zylka discloses placing light emitting diodes on the X-ray device and the medical instrument and then uses this information along with the 3D image set acquired by the computed tomography apparatus to determine the spatial correlation between the two-

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[76] *See e.g.*, Zylka, paragraph 0019.
[77] *See e.g.*, Zylka, paragraph 0019.
[78] *See e.g.*, Zylka, paragraph 0019.
[79] *See e.g.*, Zylka, paragraph 0020.
[80] *See e.g.*, Zylka, paragraph 0017.

dimensional X-ray image and the three dimensional image data set. After determination of the correlation in arithmetic unit the position of the medical instrument can be transformed into a position relative to the three dimensional image data set and this can be displayed on a monitor.[81] Nowhere does Zylka teach, disclose or suggest the feature of "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images." Nowhere does Zylka disclose using the natural human ability to perceive 3D information from animated 2D data to transfer the position and/or orientation of a surgical instrument to a user.

Unlike the technology in the present amended claim 18, Appellants respectfully submit that Zylka does not disclose, teach or suggest of "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images." Rather, unlike the present technology which uses scrolling the images to enable the user to understand the instrument information in 3D, Zylka uses an arithmetic unit to correlate the spatial correlation of the two-dimensional X-ray image and the three dimensional image data set that was derived from computer tomograms taken prior to surgical intervention.[82]

Appellants respectfully submit that paragraphs 0021-0025 of Zylka do not teach the correct limitation of claim 18.[83]. Paragraphs 0021 and 0022 relate to a method of acquiring 3D information during the pre-operative step[84] and then the two dimensional x-ray image and the

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[81] *See e.g.*, Zylka, paragraph 0020.
[82] *See e.g.*, Zylka, paragraph 0017.
[83] *See* Zylka, paragraphs 0021-0025.
[84] *See e.g.*, Zylka, paragraph 0021.

position medical instrument are determined and the correlation between the x-ray image and the overall volume three dimensional image set acquired by compute tomography apparatus.[85] Paragraph 0023 discloses determining the position of the medical instrument in the overall computed tomography image set.[86] Paragraphs 0024-0025 disclose the comparison method for determining the correlation rule for determining the correlation between the x-ray image and the three dimensional image data set.[87] Nowhere does Zylka disclose creating a 3D image set from animation of the 2D X-ray. Similarly, the combination of Jensen and Zylka fails to disclose "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images." In Jensen, the "[t]he image volume process 270 constructs a three-dimensional patient data volume in the volumetric image memory 280.[88] Or alternatively, in Jensen, "[a]lternatively or in combination with image slices, the display graphics processor 295 may construct a three dimensional rendering of the 3-D patient data volume and display the three dimensional rendering on the display 250."[89] In Zylka, "[s]uch computer tomograms form a three-dimensional image set for three dimensional; reproduction of the examination zone of patient 3."[90] As Jensen discloses using an image volume processor or a display graphics processor to construct three dimensional patient data and Zylka discloses using the three dimensional image data set from the computed tomography apparatus, nowhere does the combination of Jensen and

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[85] *See e.g.*, Zylka, paragraph 2022.
[86] *See e.g.*, Zylka, paragraph 0023.
[87] *See e.g.*, Zylka, paragraph 0024-0025.
[88] *See e.g.*, Jensen, column 10, lines 15-17.
[89] *id.* at column 10, lines 33-37.
[90] *See e.g.*, Zylka, paragraph 0018.

Zylka disclose animation of the 2D images to create 3D images through animation. Neither Jensen or Zylka alone or in theoretical combination create 3D information by animation of 2D images.

As presented above, nowhere does Zylka teach, suggest or disclose "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images" as claimed in claim 18 of the instant application. As stated above, rather than using sequential image by image presentation of 2D images to create 3D information in the technology in claim 18, Zylka uses an arithmetic unit for determining the spatial correlation between the two dimensional X-ray image and the three dimensional image data set for determining the position of the medical instrument in the three dimensional image data set.

Further, Appellants respectfully submit that the combination of Jensen and Zylka would not make the claimed invention obvious to one of ordinary skill in the art at the time of the invention. The Office Action provides no rationale for its conclusionary statement that with the combination of Jensen and Zylka, neither of which disclose the feature of "adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images" would be obvious to one of ordinary skill in the art.

Thus, for at least this reason, Appellants submit that neither Jensen nor Zylka, taken alone or in theoretical combination, teaches or reasonably suggests all the limitations of claim 18. Appellants respectfully submit that currently amended independent claim 18 is in condition for allowance.

Accordingly, independent claim 18 is not unpatentable over Jensen in view of Zylka and is allowable. Furthermore, the Appellant reserves the right to argue additional reasons beyond those set forth herein to support the allowability of claim 18.

F. Rejection of Dependent Claims 19-20

Claims 19-20 depend on independent claim 18. Therefore, the Appellant submits that claims 19-20 are allowable over the references cited in the Final Office Action at least for the reasons stated above with regard to claim 18.

II. CONCLUSION

For at least the foregoing reasons, the Appellant submits that claims 1-3 and 5-20 are in condition for allowance. Reversal of the Examiner's rejection and issuance of a patent on the application are therefore requested.

The Commissioner is hereby authorized to charge $540 (to cover the Brief on Appeal Fee) and any additional fees or credit any overpayment to the Deposit Account of GEMS-IT, Account No. 504540.

Respectfully submitted,

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CLAIMS APPENDIX
(37 C.F.R. § 41.37(c)(1)(viii))

1. A method of performing instrument tracking on an image comprising:

collecting in a collection device that rotatably moves a plurality of static 2D images using an image processing computer;

computing on a tracking data processor at least one of a position and orientation of at least one instrument for said plurality of static images; and

automatically displaying on an output device each image in said collected plurality of static 2D images in sequential image by image manner to create 3D information of said position and orientation of said instrument by creating motion through the animation process, wherein said at least one position and orientation of said at least one instrument is projected on each said image.

2. The method of Claim 1 wherein said plurality of static images comprise a plurality of 2D fluoroscopic images.

3. The method of Claim 1 comprising continuously presenting the image by image animation using a display.

4. (Cancelled)

5. The method of Claim 1 comprising calibrating at least one image of said collected plurality of static images such that said at least one position and orientation of said at least one image may be accurately displayed.

6. The method of Claim 5 comprising selecting at least one calibrated image to be a current image.

7. The method of Claim 6 comprising computing said at least one position and orientation for said at least one instrument for said current image.

8. The method of Claim 1 comprising collecting in said collection device using a image processing computer said plurality of static images using at least one moveable collection device.

9. The method of Claim 8 wherein said moveable collection device comprises a C-arm coupled to an imaging device.

10. A method of performing instrument tracking on a series of static images using an imaging device, comprising:

collecting a series of 2D static images in a collection device that rotatably moves using an image processing computer;

calibrating said series of 2D static images in said collection device using said image processing computer such that at least one of a position and orientation of at least one instrument may be accurately displayed in each image of said series of static images;

selecting at least one image of said series of 2D static images to be a current image;

computing in a tracking data processor said at least one position and orientation of said at least one instrument for said current image;

projecting said at least one position and orientation within said current image;

displaying said current image on an output device; and

automatically repeating said selecting, computing, projecting, and displaying steps to create 3D information of said position and orientation of said instrument by creating motion through the animation process using a sequential image by image presentation through said series of 2D static images.

11. The method of Claim 10 comprising collecting said series of 2D static images using a collection device that moves.

12. The method of Claim 11, wherein said collection device comprises a C-arm coupled to the imaging device.

13. The method of Claim 10 wherein said series of 2D static images comprise a series of 2D fluoroscopic images.

14. The method of Claim 10 comprising continually using said sequential image by image presentation through said series of 2D static images in a display.

15. The method of Claim 14 comprising projecting said at least one position and orientation of said at least one instrument into at least one image of said series of 2D static images.

16. The method of Claim 10 comprising incrementing at least said current image.

17. The method of Claim 16 comprising recomputing said at least one position and orientation of said at least one instrument.

18. An apparatus for performing instrument tracking on a series of static images, the apparatus comprising:

a collection device that rotatably moves and is adapted to collect a series of static images using an image processing computer;

a processing device communicating with at least said collection device and adapted to create 3D information by creating motion through the animation process by automatically and continuously presenting an image by image animation of said series of static images including at least one of a position and orientation of at least one instrument and at least

one image of said at least one instrument located at said at least one of a position and orientation; and

an output communicating with at least said processing device and adapted to display said image by image animation of said series of static images.

19. The apparatus of Claim 18 wherein said collection device that moves comprises at least one C-arm.

20. The apparatus of Claim 18 wherein said collection device that moves comprises at least one transmitter device and at least one detector device.

EVIDENCE APPENDIX
(37 C.F.R. § 41.37(c)(1)(ix))

(1) U.S. Patent No. U.S. 6,666,579 ("Jensen"), entered into record by the Examiner in the January 23, 2009 Office Action.

(2) U.S. Patent Publication No. 2001/0027263 ("Zylka"), entered into record by the Examiner in the October 27, 2010 Office Action.

RELATED PROCEEDINGS APPENDIX
(37 C.F.R. § 41.37(c)(1)(x))

The Appellant is unaware of any related appeals or interferences.